AN ACCOUNT OF THE PRINCIPLE and EFFECTS OF THE PENSILVANIAN STOVE-GRATES,

(*Which warm Rooms, &c. by a continual Introduction and Exchange of dry freſh Air*)

Commonly known by the Name of AMERICAN STOVES;

TOGETHER WITH A

DESCRIPTION OF THE LATE ADDITIONS and IMPROVEMENTS MADE TO THEM,

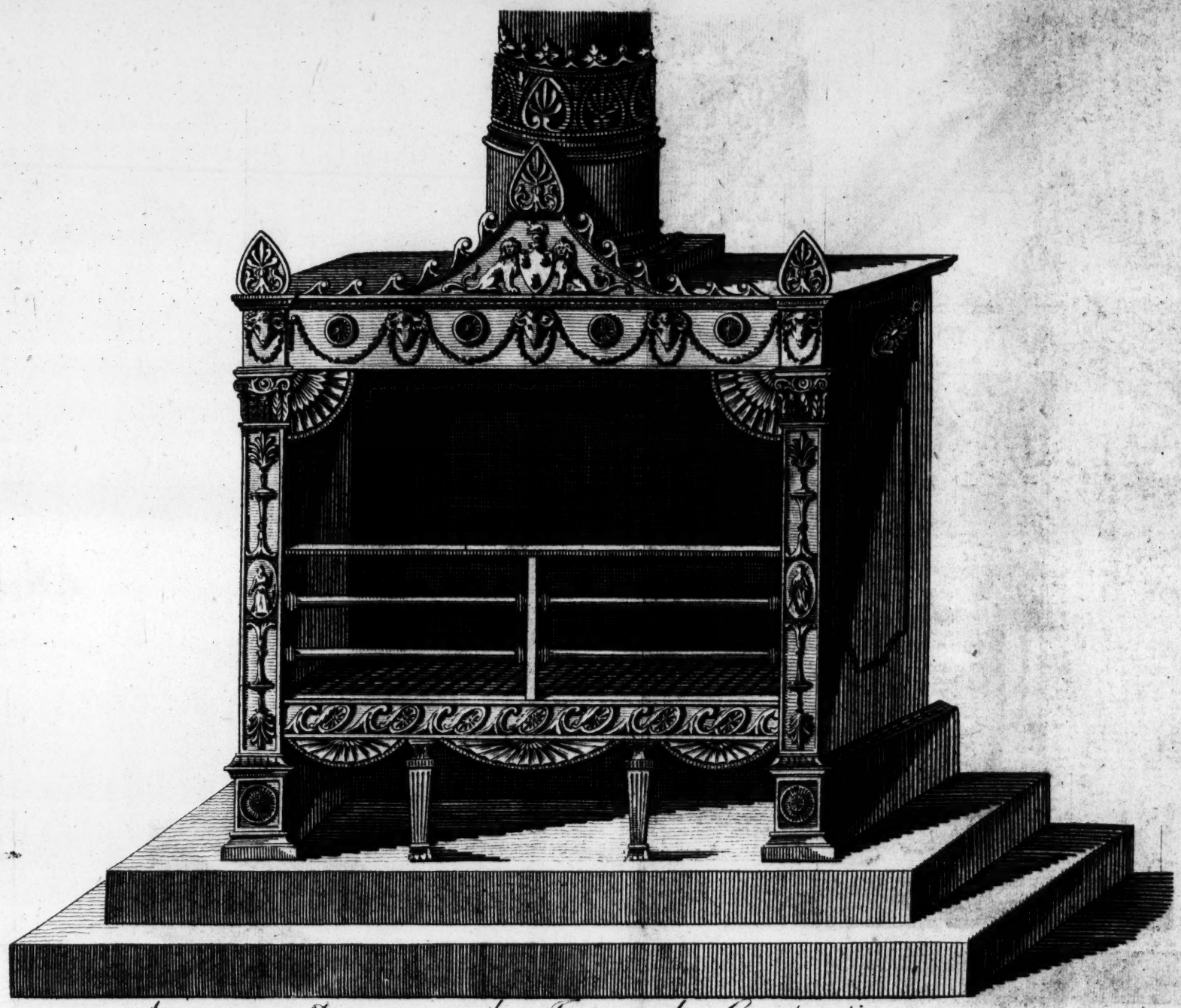
By JAMES SHARP,

(For which His Majeſty's PATENT is obtained)

No. 15, LEADENHALL-STREET, LONDON.

N. B. The Manufactory is at No. 133, TOOLEY-STREET, SOUTHWARK.

(Price Six-pence.)



AMERICAN STOVES on the Improved Construction by James Sharp Leadenhall Street

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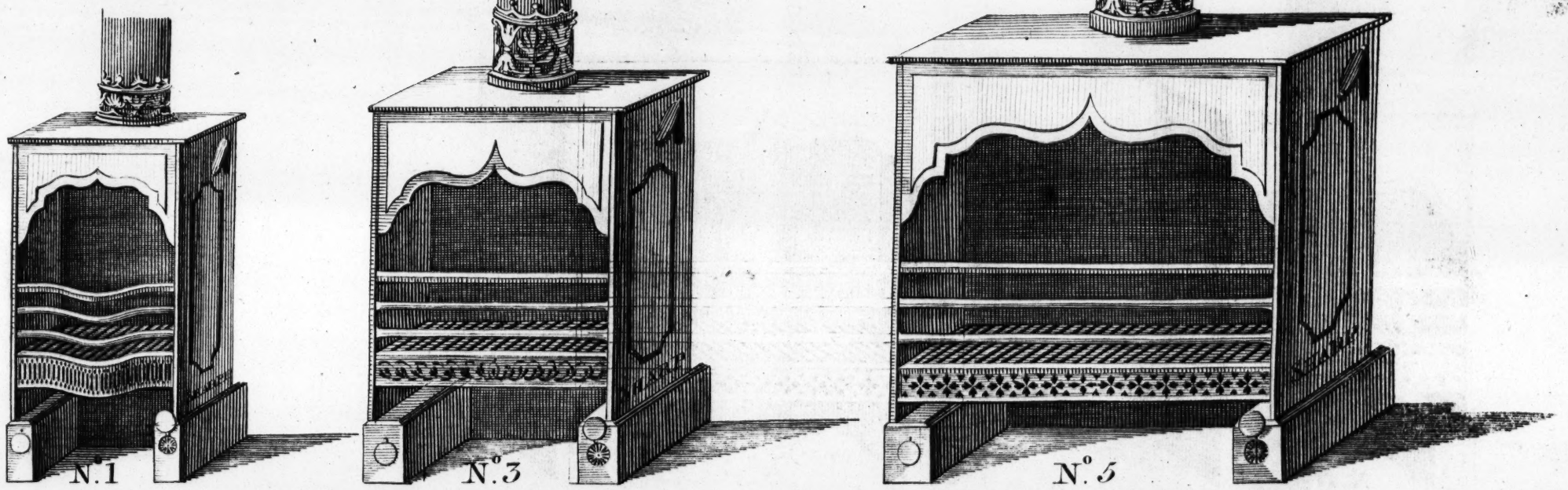

AMERICAN STOVES, ON THE IMPROVED CONSTRUCTION.

by James Sharp, Leadenhall Street.

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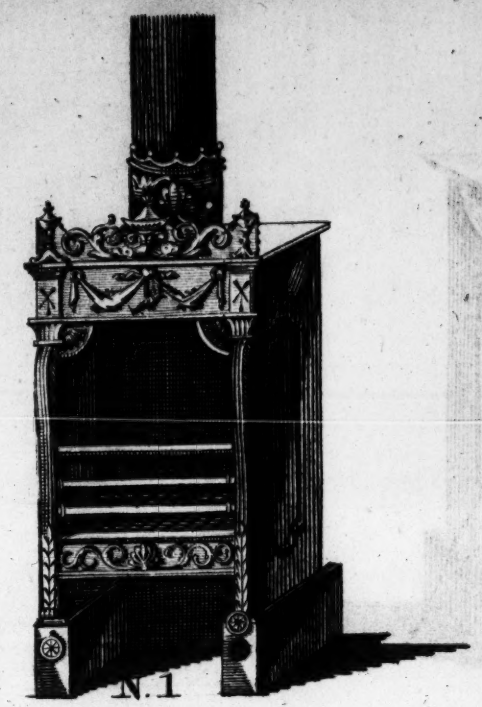

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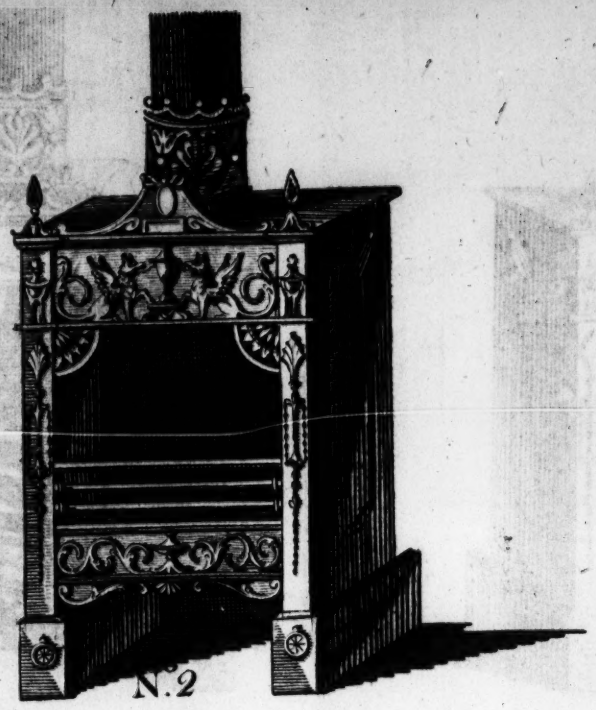

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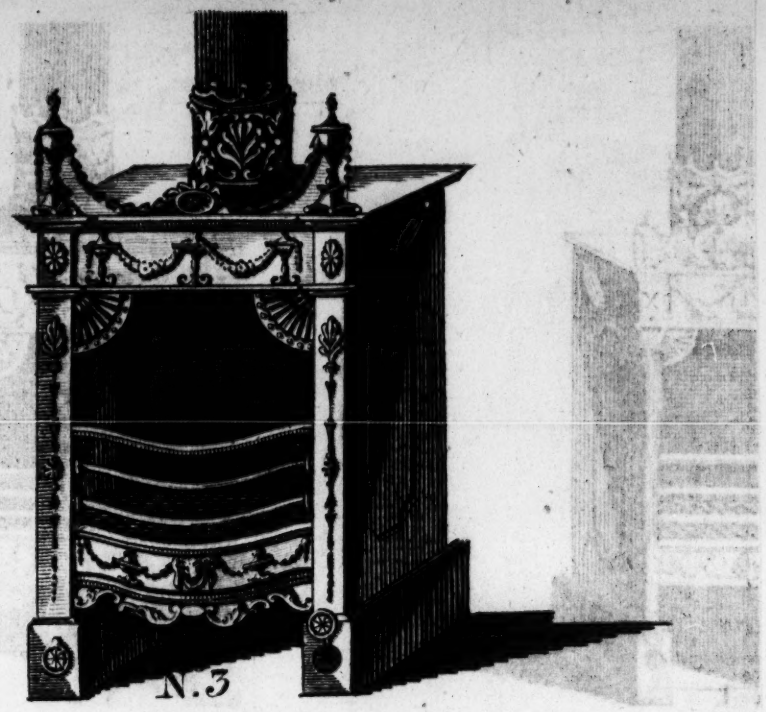

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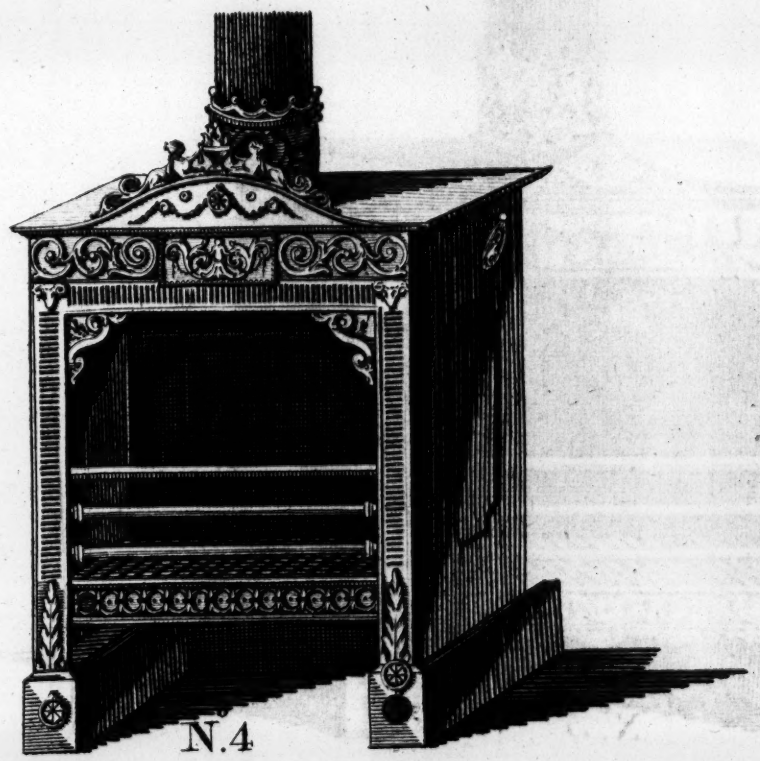

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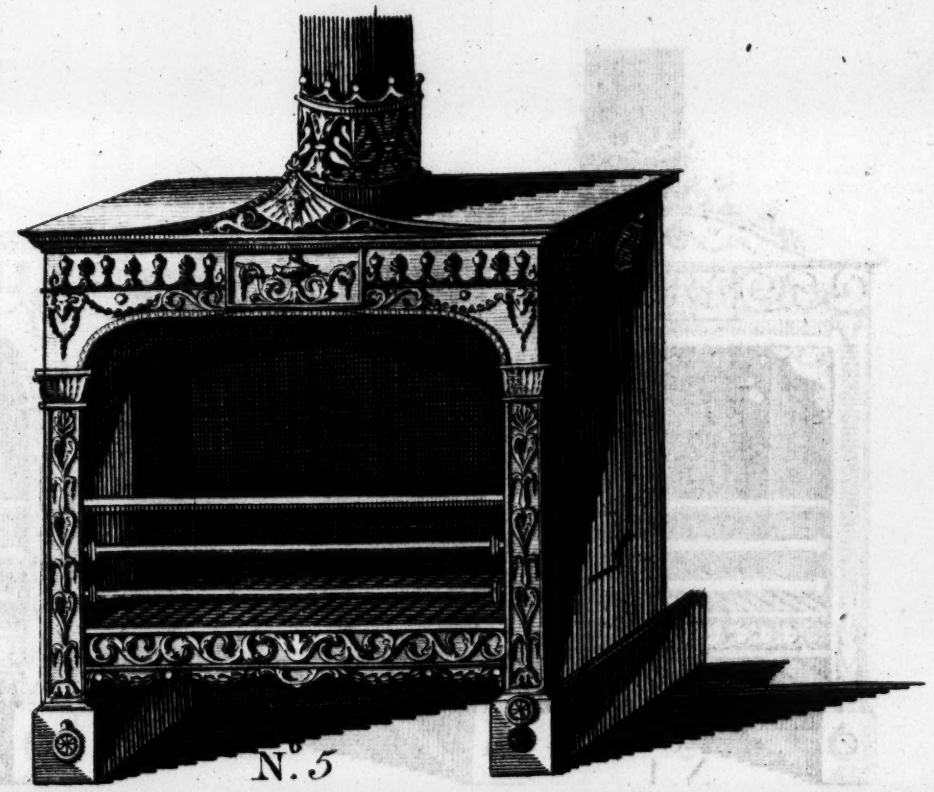

N.5

American Stoves on the Improved Construction.

by James Sharp Leadenhall Street.

Blake, fe. Abchurch Lane.

An Account of the Principle and Effects of the *Penſilvanian* Stove-Grates (which warm Rooms, &c. by a continual Introduction and Exchange of dry freſh Air) commonly known by the Name of *American* Stoves; together with ſome late Improvements made to them by JAMES SHARP, for which his Majeſty's Patent has been obtained.

THESE Stoves are called *American*, becauſe the firſt Patterns in caſt Iron upon this Principle, were the Invention of the celebrated and ingenious Dr. *Benjamin Franklin*, who then reſided in *Philadelphia*. The Principle upon which they act, is deſcribed by the Sieur *Gauger*, in his Book intitled "*Mechanique de Feu*," publiſhed in 1709; and Dr. *Franklin* ſpeaks of the Invention in his *Letters on Philoſophical Subjects*, (Page 300) as follows: "in which" (ſays he) "there are hollow "Cavities made by Iron Plates in the Back, Jambs "and Hearths, thro' which Plates the Heat paſſing, "warms *the Air* in thoſe Cavities, *which is con-* "*tinually coming into the Room* FRESH *and* WARM. "The Invention was very ingenious, and had many "Conveniences: The Room was warm'd in all "Parts by the Air flowing into it thro' the heated "Cavities; cold Air was prevented ruſhing through "the Crevices, the Funnel being ſufficiently ſup- "plied by thoſe Cavities; much leſs Fuel would "ſerve, &c. But the firſt Expence, which was "very great, the intricacy of the Deſign, and the "Difficulty of the Execution, eſpecially in old "Chimnies, diſcouraged the Propagation of the "Invention."

Theſe Difficulties were in a great Meaſure removed by Dr. *Franklin*'s Improvements: the Uſe of them became more common; and the Principle was adopted in various different Ways, where Chimnies could be found large enough to receive them; and where Communications could be conveniently made to procure a ſufficient quantity of freſh Air for their ſupply. But ſtill the Expence and Trouble of fixing them in Brickwork, and the great Delays and Difficulty of making Workmen underſtand the Manner of fixing them, remained, and has hitherto prevented their general Uſe.

But by the Additions now made to the Conſtruction, theſe Difficulties are removed; and (where Communication can be had with the external Air) they are eaſily applied to any Rooms whatever; either thoſe which have, or thoſe which have not Chimnies; ſo that not only ſmall Rooms, but the largeſt Halls, Libraries, or Churches, may be warm'd in a more effectual Manner, than has ever before been done; the greateſt Quantity of Heat being produced from any given Quantity of Fuel, that can be ſuppoſed; for theſe Stoves are effectual on every Principle by which Rooms can be warmed.

Firſt, it ſhews an handſome Fire ("which "is in itſelf a pleaſant Thing") by which the Rays of Heat are thrown out, and the full Effect of open Fires obtained, in Proportion to the Size of the Stove.

2dly, It may be detached from the Wall or Chimney, and the Air may have free Liberty to paſs round it, whereby every Advantage of the *Holland* or *German* Stove, is produced.

3dly, The Funnel or Chimney, is contracted ſo that no ſuperfluous Air is carried off, little Fuel ſerves, the Heat being almoſt all ſaved; and

4thly, The Room is ſupplied by this Stove with external or freſh Air, rarified as it enters, to a Summer Warmth, and this in ſo great a Quantity, that inſtead of cold Air ruſhing in at every Crevice, it will actually force itſelf out at Key-Holes and Chinks, whereby it is evident, a greater Exchange and better Supply of freſh Air is procured, than can be obtained by any other Method of warming yet diſcovered. And

5thly, If the Room is at any Time found too warm, there are proper Shutters to prevent the entrance of the warm rarified Air, and others which may be opened to lett in the cold Air, by ſuch commodious Channels, that the too great Warmth may be gradually exchanged, and cooled, without being liable, like the opening of Doors or Windows, to give cold to thoſe who ſit in the Room.

Thus the *American* Stove will enable the Uſer to render a Room either *Warm*, *Temperate* or *Cool*, at his Pleaſure, by the eaſy and commodious means of introducing a free Current of either warm or cold Air, as it may alternately be wanted through thoſe different Channels: Or if the Effect of a common Grate ſhould at any time be thought more deſirable, the ſtopping of theſe Channels will produce that Effect, as the *American* Stoves ſhew the Fire contained in them to as much Advantage, in Proportion to their reſpective Sizes, as any other common Grates.

The Advantages of this Fire Place.

" Its Advantages above the commom Fire Places " are,

" 1. That your whole Room is equally warm- " ed, ſo that People need not croud ſo cloſe round " the Fire, but may ſit near the Window, and " have the Benefit of the Light for Reading, " Writing, Needle-work, &c. They may ſit " with Comfort in any Part of the Room, which " is a very conſiderable Advantage, in a large Fa- " mily; or (it may be added) in Boarding-Schools, where all cannot conveniently be permitted to come near the Fire, whereby the woful Effects of Chilblains upon the poor Children too often prove the Conſequence.

" 2. If you ſit near the Fire, you have not " that cold Draught of uncomfortable Air nipping " your Back and Heels, as when before common " Fires, by which many catch Cold, being ſcorched " before, and, as it were, froze behind.

" 3. If you ſit againſt a Crevice, there is not " that ſharp Draught of cold Air playing on you, " as in Rooms where there are Fires in the com- " mon way, by which many catch Cold; whence " proceed Coughs, Catarrhs, Tooth-Achs, Fe- " vers, Plurifies, and many other Diſeaſes.

" 4. In caſe of Sickneſs, they make moſt ex-
" cellent Nurſing-Rooms, as they conſtantly ſup-
" ply a ſufficiency of freſh Air, ſo warmed at the
" ſame time, as to be no ways inconvenient or dan-
" gerous. The equal Temper too, and Warmth
" of the Air of the Room, is thought to be par-
" ticularly advantageous in ſome Diſtempers; for
" it was obſerved in the Winters of 1730 and
" 1736, when the Small-Pox ſpread in *Penſilva-*
" *nia*, that very few Children of the Germans
" died of that Diſtemper, in Proportion to thoſe
" of the Engliſh; which was aſcribed by ſome
" to the Warmth and equal Temper of the Air
" in their Stove Rooms; which made the Diſeaſe
" as favourable as it commonly is in the *Weſt*
" *Indies*. But this Conjecture we ſubmit to the
" Judgment of Phyſicians.

" 5. In common Chimneys, the ſtrongeſt Heat
" from the Fire, which is upwards, goes directly
" up the Chimney, and is loſt; and there is ſuch a
" ſtrong Draught into the Chimney, that not only
" the upright Heat, but alſo the Back, Sides, and
" downward Heats are carried up the Chimney, by
" that Draught of Air, and the Warmth given before
" the Fire by the Rays that ſtrike out towards the
" Room, is continually driven back, crouded into
" the Chimney, and carried up by the ſame
" Draught of Air; but here the upright Heat
" ſtrikes and heats the Top Plate, which warms
" the Air above it, and that comes into the
" Room. The Heat likewiſe, which the Fire
" communicates to the Sides, Back, Bottom and
" Air Box, is all brought into the Room; for
" you will find a conſtant Current of warm Air
" coming out of the Chimney-Corner into the
" Room. Hold a Candle juſt under the Mantle-
" Piece, or Breaſt of your Chimney, and you
" will ſee the Flame bent outwards. By laying
" a Piece of ſmoaking Paper on the Hearth, on
" either Side, you may ſee how the Current of
" Air moves, and where it tends, for it will turn
" and carry the Smoke with it.

" 6. Thus as very little of the Heat is loſt,
" when this Fire-Place is uſed much leſs Wood
" or Fuel will ſerve you, which is a conſiderable
" Advantage where Wood is dear.

" People who have uſed theſe Fire-Places,
" differ much in their Accounts of the Wood
" ſaved by them, ſome ſay five-ſixths, others
" three-fourths, and others much leſs. This is
" owing to the great Difference there was in their
" former Fires; ſome (according to the different
" Circumſtances of their Rooms and Chimnies)
" having been uſed to make very large, others
" middling, and others of a more ſparing Temper,
" very ſmall ones; while in theſe Fire-Places
" (their Size and Draught being nearly the ſame)
" the Conſumption is more equal; I ſuppoſe,
" taking a Number of Families together, that
" two-thirds, or half the Wood at leaſt, is ſaved.
" My common Room I know, is made twice as
" warm as it uſed to be, with a Quarter the
" Wood I formerly conſumed there."

If what Dr. *Franklin* mentions here be true, the Saving is great indeed, and that the Fact is ſo, I have no kind of Doubt; for I have uſed *American* Stoves in ſeveral Rooms in my Houſe, for many Years with great Advantage; my Dining Room in particular, which has a large old faſhioned Chimney, was formerly ſo cold as to be diſuſed by my Predeceſſors in cold Weather; for the largeſt Fires that could be made did not warm it: but ſince the ſame Room has had an *American* Stove (which is near Twenty Years) it has been as comfortable with reſpect to warmth as any Room can be made; and with reſpect to the ſaving of Fuel, it is impoſſible for me to ſay exactly, how great the ſaving has been; but I can with great Truth aſſert, it has been many Times more than the original Coſt of the Stove.

" 7. When you burn Candles near this Fire-
" Place, you will find that the Flame burns quite
" upright, and does not blare and run the Tallow
" down, by drawing towards the Chimney, as
" againſt common Fires.

" 8. This Fire-Place cures moſt Smoaky Chim-
" nies, and thereby preſerves both the Eyes and
" Furniture.

" 9. It prevents the fouling of Chimnies; much
" of the Lint and Duſt that contributes to foul
" a Chimney, being by the low Arch, obliged to
" paſs through the Flame, where it is conſumed,
" then leſs Fuel being burnt, there is leſs Smoak
" made. Again, by hanging on the Blower a
" Flame is ſoon produced, and in conſequence
" the ſame Fuel does not yield ſo much Smoke,
" as if burnt in a common Chimney, for as ſoon
" as Flame begins, Smoke in Proportion ceaſes.

" 10. And if a Chimney ſhould be foul, it is
" much leſs likely to take Fire; if it ſhould take
" Fire, it is eaſily ſtifled and extinquiſhed.

" 11. A Fire may be very ſpeedily made in
" this Fire-Place by the Help of the above-
" mentioned Blower. With all theſe Conveni-
" cies you do not loſe the pleaſing Sight nor Uſe
" of the Fire."

OBJECTIONS anſwered.

" There are ſome Objections commonly made
" byPeople that are unacquinted with theſe Fire
" Places, which it may not be amiſs to endeavour
" to remove, as they ariſe from Prejudices, which
" might otherwiſe obſtruct, in ſome Degree, the
" general Uſe of this beneficial Machine.

" We frequently hear it ſaid, *They are of the*
" *Nature of Dutch Stoves; Stoves have an unplea-*
" *ſant Smell; Stoves are unwholeſome; and warm*
" *Rooms make People tender, and apt to catch Cold.*"

As to the firſt, that *they are of the Nature of Dutch Stoves,* the Deſcription of theſe American Stoves already given in the Beginning of this Paper " ſhews that there is a moſt material Dif-
" ference, and that theſe have vaſtly the Advan-

" tage, if it were only in the ſingle Article of the " Admiſſion and Circulation of the freſh Air;" for the Dutch Stoves only warm the Air in the Room; but theſe, by the Heat of the Fire in the Room, attract ſo great a quantity of external freſh Air through the warming Tube or Air Box at the Back of each Stove, that the Air of the Room is continually changing, as the Current of warm freſh Wind is conſtantly ruſhing into the Room through the ſaid Air Box, which muſt occaſion a moſt wholeſome Circulation, to carry off by it all internal Air that would otherwiſe for want of change, be rendered unfit for Reſpiration.

" But it muſt be allowed there may have been " ſome cauſe to complain of the *offenſive Smell* " *of Iron Stoves*; this Smell, however, never " proceeded from the Iron itſelf, which, in its " Nature, whether hot or cold, *is one of the* " *ſweeteſt of Metals*, but from the general un- " cleanly Manner of uſing thoſe Stoves. If they " are kept clean, they are as ſweet as an Ironing " Box, which, though ever ſo hot, never offends " the Smell of the niceſt Lady: But it is com- " mon to let them be greaſed, by ſetting Candle- " ſticks on them, or otherwiſe, to rub greaſy " Hands on them; and, above all, to ſpit upon " them, to try how hot they are; which is an " inconſiderate, filthy, unmannerly Cuſtom; for " the ſlimy Matter of Spittle drying on, burns " and fumes when the Stove is hot, as well as the " Greaſe, and ſmells moſt nauſeouſly; which " makes ſuch cloſe Stove Rooms, where there is " no Draught to carry off thoſe filthy Vapours, " almoſt intolerable to thoſe that are not from " their Infancy accuſtomed to them; at the ſame " Time, nothing is more eaſy than to keep them " clean;" for when by any Accident they happen to be fouled, nothing more is neceſſary, to ſcour them perfectly, than a common hard Bruſh, well applied.

" That hot Iron of itſelf gives no offenſive " Smell, thoſe know very well who have been " preſent at a Furnace when the Workmen were " pouring out the flowing Metal to caſt large " Plates, and not the leaſt Smell of it to be perceived. " That hot Iron doth not, like Lead, Braſs and " ſome other Metals, give out unwholeſome Va- " pours, is plain from the general Health and " Strength of thoſe who conſtantly work in Iron; " as Furnace-men, Forge-men, and Smiths.

" That it is in its Nature a Metal perfectly " wholeſome to the Body of Man, is known from " the beneficial Uſe of Chalybeate, or Iron Mine " Waters; from the good done by taking Steel " Filings in ſeveral Diſorders; and that even the " Smithy Water in which hot Irons are quenched, " is found advantageous to the Human Conſtitu- " tion. The ingenious and learned Dr. *Deſaguliers*, " to whoſe inſtructive Writings the Contriver of " this Machine acknowledges himſelf much in- " debted, relates an Experiment he made, to try " whether heated Iron would yield unwholſome " Vapours: He took a Cube of Iron, and having " given it a very great Heat, he fixed it ſo to a " Receiver, exhauſted by the Air Pump, that all

" the Air ruſhing in to fill the Receiver, ſhould " firſt paſs through a Hole in the hot Iron. He " then put a ſmall Bird into the Receiver, who " breathed that Air without any Inconvenience, " or ſuffering the leaſt Diſorder. But the ſame " Experiment being made with a Cube of hot " Braſs, a Bird put into that Air died in a few " Minutes. Braſs, indeed, ſtinks even when cold, " and much more when hot: Lead too, when " hot, yields a very unwholeſome Steam; but " Iron is always ſweet, and every way taken is " wholeſome and friendly to the Human Body, " except in Weapons.

" *That warm Rooms make People tender and apt* " *to catch Cold*, is a Miſtake as great as it is " (among the Engliſh) general. We have ſeen " in the preceding Pages how the common " Rooms are apt to give Cold; but the Writer " of this Paper muſt affirm from his own Expe- " rience, and that of his Family and Friends who " have uſed warm Rooms for theſe four Winters " paſt, that by the Uſe of ſuch Rooms People " are rendered leſs liable to take Cold, and, " indeed actually hardened, If ſitting warm in a " Room made one ſubject to take Cold on going " out, lying warm in Bed ſhould, by a parity of " Reaſon, produce the ſame Effect when we riſe; " yet we find we can leap out of the warmeſt Bed " naked, in the coldeſt Morning, without any " ſuch Danger, and in the ſame Manner out of " warm Cloaths into a cold Bed. The Reaſon " is, that in theſe Caſes the Pores all cloſe at " once, the Cold is ſhut out, and the Heat within " augmented, as we ſoon after feel by the glow- " ing of the Fleſh and Skin. Thus no one was " ever known to catch Cold by the Uſe of a Cold " Bath; and are not Cold Baths allowed to harden " the Bodies of thoſe that uſe them? Are they " not therefore frequently preſcribed to the ten- " dereſt Conſtitutions? Now every Time you go " out of a warm Room into the freezing cold Air, " you as it were, plunge into a Cold Bath, and " the Effect is in Proportion the ſame; for tho' " perhaps you may feel ſomewhat chilly at firſt, " you find in a little Time your Bodies hardened " and ſtrengthened; your Blood is driven round " with a briſker Circulation, and a comfortable, " ſteady, uniform inward Warmth, ſucceeds that " equal outward Warmth you firſt received in the " Room. Farther to confirm this Aſſertion, we " Inſtance the Swedes, the Danes, and the Ruſ- " ſians: Theſe Nations are ſaid to live in Rooms, " compared to ours, as hot as Ovens; yet where " are the hardy Soldiers, though bred in their " boaſted cool Houſes, that can, like theſe Peo- " ple, bear the Fatigues of a Winter Campaign " in ſo ſevere a Climate; march whole Days up " to the Neck in Snow, and at Night entrench " in Ice as they do?

" The mentioning of thoſe Northern Nations, " puts me in Mind of a conſiderable Publick " Advantage that may ariſe from the general Uſe " of theſe Fire-Places. It is obſervable, that " though theſe Countries have been well inha- " bited for many Ages, Wood is ſtill their Fuel, " and yet at no very great Price; which could

" not have been if they had not univerſally uſed " Stoves, but conſumed it as we do, in great " Quantities by open Fires. By the Help of " this ſaving Invention our Wood may grow as " faſt as we conſume it, and our Poſterity may " warm themſelves at a moderate Rate, without " being obliged to fetch their Fuel over the " *Atlantick*; as, if Pit-Coal ſhould not be here ", diſcovered (which is an uncertainty) they muſt " neceſſarily do.*

* This Tract was printed in *Philadelphia* by Dr. *Franklin*, in 1745.

" We leave it to the political Arithmetician to " compute how much Money will be ſaved to a " Country by its ſpending two-thirds leſs of Fuel; " how much Labour ſaved in cutting and carriage " of it; how much more Land may be cleared " by Cultivation; how great the Profit by the " additional Quantity of Work done, in thoſe " Trades particularly that do not exerciſe the " Body ſo much, but that the Workfolks are " obliged to run frequently to the Fire to warm " themſelves: And to Phyſicians to ſay, how " much healthier thick built Towns and Cities " will be, now half ſuffocated with ſulphury " Smoke, when ſo much leſs of that Smoke ſhall " be made, and the Air breathed by the Inha- " bitants be conſequently ſo much purer."

Now as Flame is nothing more than burning Smoke, and as by leſs Fuel being burnt in the Stoves leſs Smoke is made; and as a very great Proportion of the Smoke that is made will be conſumed in Flame; this laſt Obſervation of Dr. *Franklin*'s muſt certainly be a very ſtrong Argument for their general Uſe in this great Metropolis.

After the foregoing Objections fairly ſtated, and ſo ably refuted by Dr. *Franklin*, I think myſelf bound in Juſtice to mention ſuch Objections as occurred or have been mentioned to me, and have not been noticed by him; and theſe are, That they are apt to occaſion Duſt, and that ſometimes Rooms are made too hot; both which I have ſometimes found true: But to the firſt of theſe Objections, I anſwer, it exiſted only when the Throat of the Chimney has been clogged with Soot, to which they cannot now be liable, becauſe the Funnel may eaſily be clean'd every Day, if neceſſary. To the latter, I anſwer, *make leſs Fire*, or open the Channel which admits cold Air, either of which is an effectual Remedy.

With all the Advantages above-mentioned, it is almoſt ſurprizing that the American Stove ſhould not have been more commonly uſed; and nothing can account for it, but the difficulty hitherto of having them properly fixed in Brick Work; which Difficulty the Alterations now made do effectually obviate, for they may now be eaſily placed in any Chimney whatever, nay (in many Situations) better without any other Chimney than its own Iron Funnel.

Two of these Stoves, of a large Size, are placed in St. *John's* Church, *Southwark*, the Funnels of which are carried strait up through the Galleries and Roof. They are placed opposite to each other, about the Middle of the Church, and the Effect is as compleat as could possibly be desired for the Purpose. A Testimony of this I received in a Letter from a very respectable Inhabitant, as follows;

" I have the Pleasure to inform you the Stoves " warm'd the Church extreamly well, notwith- " standing the many Air-Holes; and, perhaps, " you will be surpriz'd to hear several of the " Parishioners have expressed their Fears of catch- " ing Cold when they go out of the Church, *&c.*"

" To Mr, James Sharp, Leadenhall-street,"
" *January* 26, 1781."

St. *John's* Church is a very elegant and large Building of Stone, and consequently appears damp, after severe Weather, as the coldness of the Stone is apt to condence the Air into Water, which wets and trickles down the Walls. This same Effect is remarkable also in St. *Paul's* Cathedral, where, after cold Weather, the Water does frequently fall in large Drops, like Rain, round the Circle of the Dome; this always happens, more or less, in Proportion as the external Air is warmer than the Stone, and the Air in the Inside of the Church, and in Proportion to the Quantity of the warmer Air admitted by opening the Doors, *&c.* this has been proved by opening the larger Doors, as a supposed Remedy for the Damp, but which only increases the Evil; whereby it is apparent that this Moisture, or seeming Dampness, arises from the warmer Air being condensed by the coldness of the Stone, which must be more or less, in every other Stone Building, upon sudden Changes of Weather.

In St. *John's* Church (where these Stoves are now placed) it has been usual to employ Women every *Sunday* Morning with Cloths to wipe and dry the Pillars and Walls before the Congregation assemble; but it is now observed, that after the Stove Fires have been made a few Hours, no such Damp can be found.

After so much has been quoted from the learned Dr. *Franklin* in Favour of these Fire-Places, I may perhaps be charged with Presumption for saying more about them; but as his Commendations apply intirely to the Sort he then used, I hope I may be excused if I add a few Words more upon the present Improvements.

By the Funnels, which I have added to the Top, the Stoves are rendered applicable to any Chimney, or (by Length of Funnel) to any Place without a Chimney.

By the hollow Base, I apply them with much greater Effect to the external Air, and without any Addition of Brick Work. And,

By the Alterations in the Air-Box a much greater Quantity of warm Air is introduced, than

could poſſibly be in their former State. Of this I have made a fair Experiment in St. *John's* Church; for the Air Box of the Stove, on the North-Side, is exactly agreeable to Dr. *Franklin's* Pattern; but the Air-Box of the Stove on the South-Side is ſo altered as to produce an amazing difference of Effect, for the Air-Holes of the latter will act more forcibly at a Foot diſtance than the former at Two Inches; and, I believe, I may, with Truth, ſay that this Church is the firſt Stone Building of its Kind and Size, that has ever been made comfortably warm by Fires.

JAMES SHARP,

Leadenhall-Street, Feb.

Many different Sizes and Patterns of theſe Stoves may be ſeen at Mr. *Sharp's* Manufactory, No, 133, *Tooley-ſtreet*, *Southwark*; or at his Houſe, *Leadenhall-ſtreet*, *London*.

A Liſt of ſome other Articles that are uſually made, and may be ſeen at Mr. SHARP's Manufactory in TOOLEY-STREET.

ANCHORS of every Size, from an Half Hundred Weight, to 40, 50 or 60 ℔.

Grapnals and Creepers of every Size.

A Ship's Windlaſs, of a particular Conſtruction (by Capt. *Stephen Wright*, of *North Shields*): it ſtops the Cable at every Inch, is perfectly ſafe, has been ſo much approved of, that many Hundreds of them have been made. They are much uſed in the Coal Trade.

Iron Axle-trees, or Screw bolted Arms for every Sort of Carriage.

Gudgeons, Caſes and Braſſes, Steps, Cappooſes, Screw Bolts, Hoops, and every other Sort of wrought or caſt Iron Work, truly turn'd, for Sugar Mills.

Several particular Patterns of Iron Windmill Shafts for reducing Friction, with Iron Croſſes for the Fanns, *&c.* which have been much approved; alſo Timber Work, if required, fitted to every Part of the Mill.

Screwed Bolts and Nuts of every Diameter, for Sugar Millwork, the ſame being cut in the Mill, and without Heads, ſo that they may eaſily be ſhortened or lengthened by the Uſers to whatever Length they want.

Beſides the ſeveral Kinds of Rolling Carriages mentioned in my Book of Prints, every Sort of Wains, Waggons, Carts, *&c.* either broad or narrow Wheel'd, for Weſt India Planters Uſe, are made, as well as Trucks particularly conſtructed for Sugar Hogſheads.

Several Sorts of Street or Porter Trucks.

Several Sorts of Rolling Trucks for Warehouſes.

Several Sorts of Tumbril Carts for one or two Horſes, from 9 to 12 Inch broad Wheels.

Bottle Carts, Fiſh Carts, Baggage Carts or Caravans, on Springs or Braces.

Several Sorts of Cart Rollers, from 18 Inch to 3 Feet high, truly turn'd, and divided from 1 Foot to 7 Feet broad.

Caſt Iron Rollers, truly turn'd and divided, of any Size or Dimenſions whatever, to be drawn by Men or Horſes.

Every Sort of Rolling Carriage, together with Rollers adapted to hang behind Carts, *&c.* for Graſs Rolling.

Divided Garden Rollers and Cart Rollers for Land. See the ſeveral Prints in my former Book.

Ploughs of every Kind.

Hertfordſhire. Welch.
Cambridge. Dutch.
Rotherham.
Trenching Plough, by Ducket.
Foot Ploughs made entirely of Iron.
Carriage Ploughs entirely of Iron.
Arbuthnot's Draining Plough, improved by Rack and Pinion.
Kentiſh or Turn Wriſt Plough.
Improvement on ditto by Rack and Pinion.
Drill Ploughs of ſeveral Sorts
Horſe Hoes of ſeveral Sorts
Drill Plough by Ducket, for Broad-caſt Sowing.
Man-Hoe by Ducket, to be drawn by Men and fitted to the Broad-caſt Plough.
Horſe Shovels for Ant-Hills.
Horſe Shovels for removing Earth to ſhort Diſtances, and for levelling uneven Ground. Theſe are a remarkable expeditious Machine; they load themſelves, carry the Load, and deliver it where wanted; and the Horſes proceed forwards, and back again for a new Load, without ever ſtopping either to load or unload.
Navigation Wheelbarrows—Brindley's Pattern.
Machines for ſlicing Turnips.
Scattering Barrows, ſeveral Kinds. See the Print.
Caſting, Ditching, Navigation and Garden Spades.
Ballaſt Spoons, Nets and Drag Scoops.
Hand Cranes of Several Patterns.
Screw Jacks, double and ſingle, and of ſeveral Sizes.
Screw Jacks, a particular Pattern, for Carriages.
Iron Blocks with Braſs Sheaves, ſeveral Kinds.
Combination ditto, Smeaton's Pattern.
Snatch Blocks for different Uſes.
Cocoa Hooks and Cotton Rollers for Weſt Indies.
Bear, Fox, and Garden Traps, ſeveral Sorts.
Blaſting Tools in Sets, for Mines, Quarries, *&c.*
Boring Tools for Earth Boring.
Cranes of various Conſtructions.
Weighing Engines, portable, for weighing great Weights, Horſes, Cattle, Waggons, *&c.*
Horſe Rakes for various Purpoſes.
Winnowing Machines.
Steel and Quern-ſtone Mills of many Kinds.
Bolting Mills of various Sorts
Iron Cheſts, Bookcaſes, and Iron Safes of every Sort.
Stoves *for the Introduction of warm'd Air* (not only of the Kind already deſcribed as *American* Stoves) but alſo upon the Principle of an inverted Syphon, ſuch as are erected in the Foundling Hoſpital, Bank, *&c.*
Fire Engines to a particular Pattern.
Forcing Pumps.
Square ditto and Boxes, made from Plank.
Shanks and Bits for Pump Boring.
Iron Railing, Ship Work, *&c.*

Together with ſeveral other uſeful Things in rough Mechaniſm.

Moſt of the Articles above mentioned are fully deſcribed in my Book of Prints and Deſcriptions already publiſhed.

N. B. Horſes are conſtantly ready at the Manufactory, to ſhew the Effects of the ſeveral Rakes, Ploughs, Shovels, *&c.* or to draw the different Sorts of Carts, Waggons, or Rollers, whereby Judgment may be formed of the Utility of each Machine. The loweſt Price is fixed upon each Article, and Payment will be expected on Delivery of the Goods.

Directions for fixing the American Stove.

IF a Stove of this Kind is to be placed in a common Fire Place, a Hole muſt be made through the Back of the Chimney, or through the Hearth, to communicate with the external freſh Air; and this Hole ſhould be made as large as Circumſtances will admit, always obſerving to make the Hole deſcending, if poſſible, ſo that the outward Air may aſcend towards the Stove.

The Hollow Baſe of the Stove muſt be placed againſt this Hole, ſo as to cover it compleatly, and the Joints well pointed with Lime or Puttey, ſo cloſe that the Air may not paſs through it.

Then a few Feet of Iron Funnel muſt be put upon the Stove, to reach above the Breaſt of the Chimney; and the Chimney incloſed by Iron Plates, or in any other Maner; but ſo that it be eaſily removed when the Chimney wants ſweeping.

When this is done, the warm Air introduced by the Stove will be carried into the Room, which otherwiſe (where it is not incloſed) would paſs up the Chimney and be loſt.

But if the Stove is to be fixed in a Room where there is no Chimney, it may be placed in any Part of it, where Communication may be had with the outward Air; and nothing more is neceſſary than a ſufficient Length of Funnel to carry it through the Roof, or Wall, or Window, or into any other Chimney that may be convenient.

Reference to the PLATES.

The Stove in the firſt Plate is the Pattern now placed in *Draper's-Hall*, and St. *John*'s Church *Southwark*; the Pattern is very elegant (as appears by the Print) and fit for any Church, Hall, Library or Public Building, and the Carving may be vary'd at Pleaſure.

The Stoves in the ſecond Plate are the Firſt, Third and Fifth Size, of the Patterns I have already made.

The Holes and the Shutters, as they appear in the Print at the Side of the Stoves, are the Channel for the Introduction of warm Air. And,

The Holes, or Ventilators, near the Bottom, at the Front of the Baſe, are the Funnels for Introduction of cold Air, if the Room is too hot; when theſe are opened, the Channel for hot Air muſt be ſhut, and *vice verſa*.

A DESCRIPTION OF THE Improved *Penſilvanian* STOVE-GRATES.

1781.